Check Active Surface Zernikes

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1 Check Active Surface Zernikes

Here we attempt to illustrate how the Active Surface Zernikes work. We ran scans with the Active Surface in which the 'write to file' option was selected. We then analyzed the generated FITS and ASCII files to see if the results matched what we expected. We're not sure what the values in the FITS files correspond to, but the ASCII values contain x, y, z values, where x and y are the positions of each actuator (in some unknown reference frame), and z is the displacement of the actuator (again, in what frame)? This displacement is partially the result of the zernike polynomials using the rho and theta value for each actuator in a config file: etc/config/AsZernike.conf. This result is also multiplied by a phi also from the same file. This will be important further down.

1.1 What we expect

We'd like the data we analyze to eventually look something like the zernike pyramid (NOLL notation):

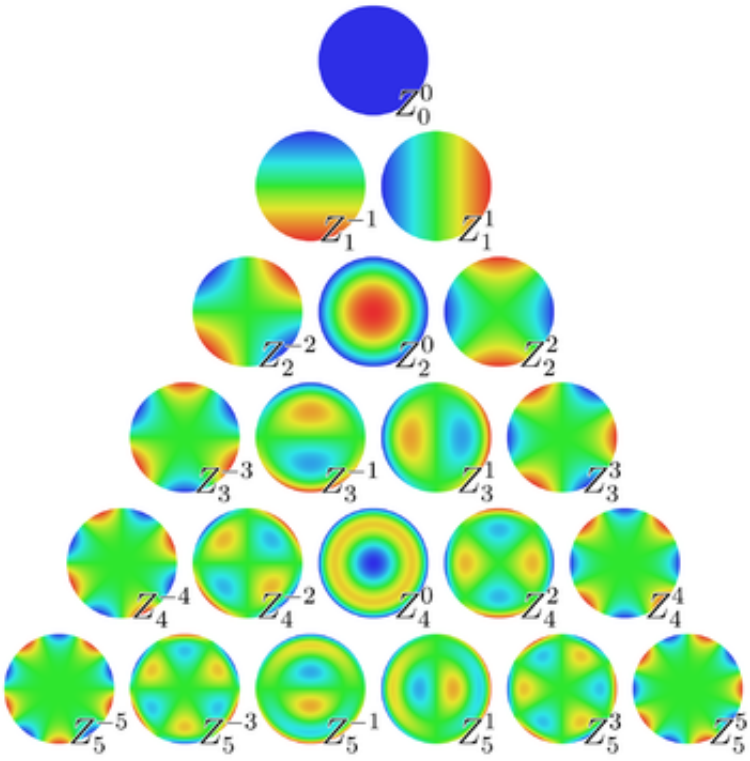
```
In [1]: #%matplotlib notebook
        import matplotlib.pylab as plt
        from mpl_toolkits.mplot3d import axes3d, Axes3D

        # here's the module we use to analyze our results
        from analyzeActiveSurface import *
```

1.2 Run Scans with original Active Surface

In the below analysis, we look at both the FITS and ASCII results. The last plot is a summary of all the ASCII data (after a simple smoothing for regridding purposes). The Scans were conducted as follows: [SCAN] [Zernikes]

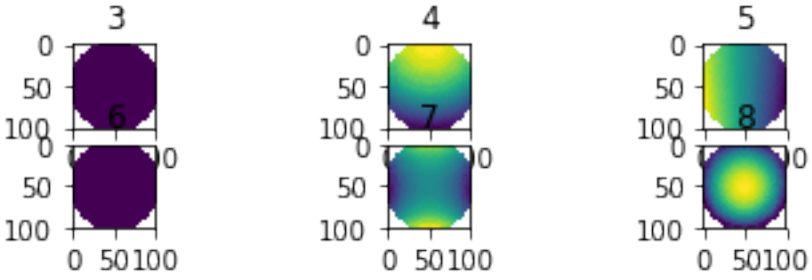
3 (all Zernikes set to zero)
4 N1=100.
5 N2=100.
6 N3=100.
7 N4=100.
8 N5=100.

```
In [2]:     path = "simdata/TINT_080219/"
            analyzeActiveSurfaceScans(path, range(3,9))
```



zernikes

```
['# Active surface commands at 22.009742\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 21.993286\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 21.973674\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 21.941625\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 21.930247\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 21.908776\n', '# Zero points are Off, FEM corrections are Off\n']
```



1.2.1 This last plot doesn't represent the first 6 images in our Zernike plot!

Hmm. Why not? I'm guessing it has to do with the phi that we are multiplying our result by.

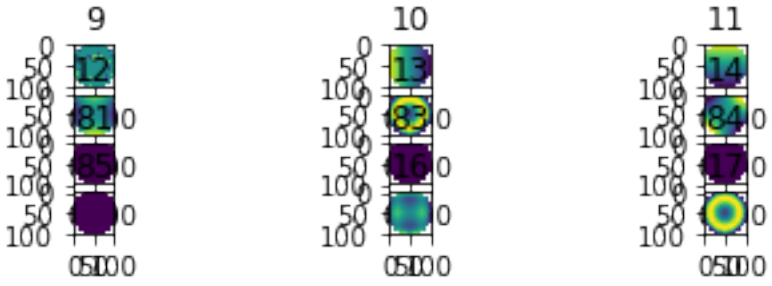
1.3 Run scans with Hacked Active Surface

We hacked the Active Surface to remove the multiplication of each actuator's phi to the result.

[SCAN] [Zernikes]
9 N1=100.
10 N2=100.
11 N3=100.
12 N4=100.
13 N5=100.
14 N6=100.
16 N12=100.
17 N13=100.

```
In [3]:     path = "simdata/TINT_080219/"
            scans = range(9, 15) + [81] + range(83, 86) + [16, 17]
            analyzeActiveSurfaceScans(path, scans)
```

```
['# Active surface commands at 22.230261\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 22.264249\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 22.290261\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 22.544740\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 22.916395\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 22.590868\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 34.807891\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 35.197859\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 35.303778\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 35.428465\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 22.953231\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 23.043452\n', '# Zero points are Off, FEM corrections are Off\n']
```

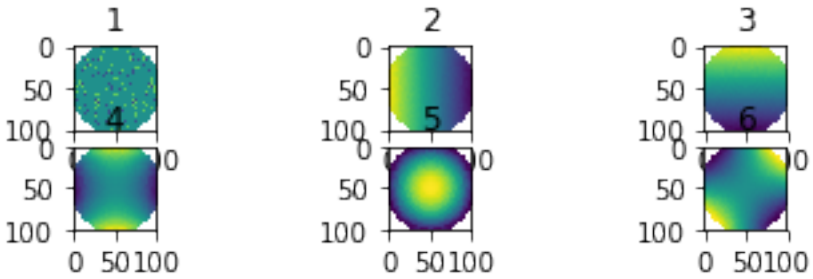


1.4 Use Hacked Active Surface again, but better

This time we don't screw up and we go all the way from 1 to 15. This shows that we are definitely just traversing the pyramid right to left instead of left to right.

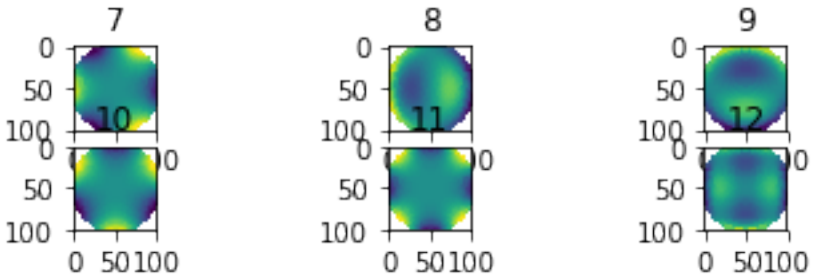
In [4]:
```
path = "simdata/TINT_210219/"
scans = range(1, 7)
analyzeActiveSurfaceScans(path, scans)
```

```
['# Active surface commands at 37.444657\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 37.865016\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.176496\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.286664\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.337811\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.386345\n', '# Zero points are Off, FEM corrections are Off\n']
```



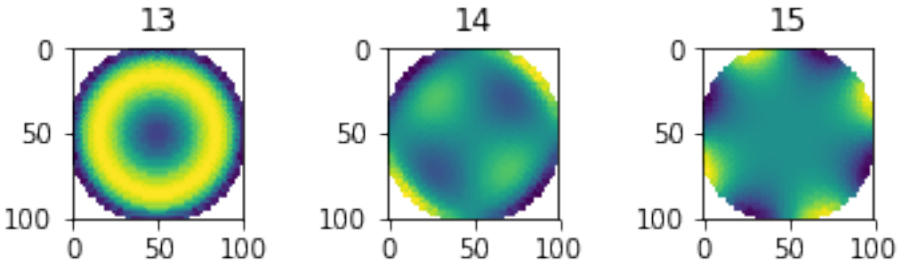
In [5]:
```
scans = range(7, 13)
analyzeActiveSurfaceScans(path, scans)
```

```
['# Active surface commands at 38.452672\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.501076\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.549426\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.612960\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.658646\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.701748\n', '# Zero points are Off, FEM corrections are Off\n']
```



In [6]:
```
scans = range(13, 16)
analyzeActiveSurfaceScans(path, scans)
```

```
['# Active surface commands at 38.747336\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.797932\n', '# Zero points are Off, FEM corrections are Off\n']
['# Active surface commands at 38.866138\n', '# Zero points are Off, FEM corrections are Off\n']
```

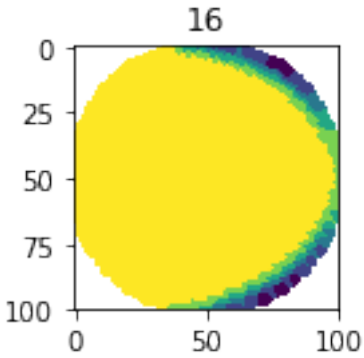


2 What does it look like from the bump scan?

What if we send the results from our LASSI Data Analysis Pipeline? It's hard to tell:

```
In [7]: analyzeActiveSurfaceScans(path, [16])
```

```
['# Active surface commands at 51.631865\n', '# Zero points are Off, FEM corrections are Off\n']
```




```
In [ ]:
```